



**Third United Nations
International Conference
on the Peaceful Uses
of Atomic Energy**

A/CONF.28/A/6
CANADA

February 1964

Original: ENGLISH

Confidential until official release during Conference

Abstract

STUDIES OF CANDU-TYPE REACTORS IN THE 500-MW(e) RANGE

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1. The D₂O-cooled CANDU-type reactor has exceptional potential for development to higher power and lower energy costs. The concept is clearly established with the operation of the 20-MW(e) NPD plant and the design and construction of the Douglas Point station. The power cost from the first 200-MW(e) unit at Douglas Point is expected to be approximately \$(Can) 5.5×10^{-3} /kWh, based on operation for 7000 hours per year and a fixed-charge rate of 6.5 percent. If a number of these 200-MW(e) plants were built in succession utilizing current designs and overlapping construction, power could be produced at a price fully competitive with other forms of generation in many areas in the world.
2. However it has been evident for some time that substantial savings in capital and power cost would result from building larger reactor plants. The pressure-tube reactor can be designed and built in any size acceptable to a utility. Increasing the size from 200 MW(e) to 500 MW(e) without any technological changes in conditions or materials would result in a capital-cost saving of about \$(Can)100 /kW(e) of installed capacity. The resulting power-cost reduction would be 20 percent. Substantial reductions in cost would result from further increases in reactor size to 1000 MW(e) - and perhaps beyond.
3. Power-cost reductions are also predicted from a number of technological improvements and by reductions in time of construction. Technical changes which could result in power-cost savings include increased fuel ratings, improved high-strength materials for pressure-tube construction, allowing the coolant to boil in the core, axial flattening of the neutron flux, and higher operating temperatures. These changes would lead to a smaller core and substantial savings in power cost. Savings in construction cost and time, and in capital and operating costs, would result from building a number of units in succession at one site.

4. The low fuelling cost which results from the use of natural-uranium fuel and D₂O moderation would prevent future obsolescence as larger advanced plants are built. There is promise of even lower fuelling cost with increased fuel fabrication throughput as the nuclear industry develops.
5. A design study for the construction of a 500-MW(e) reactor as the first unit of a multi-reactor generating station in southern Ontario is in progress and the conclusions reached can be reported in some detail by September, 1964.